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SUCCESSFUL MECHANICAL TREATMENT
OF SOME UNUSUAL AURAL CONDITIONS.*

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THE writer has employed with success a mechanical device in the treatment of certain rare aural conditions to which he desires to call your attention this evening. The history of the first case briefly is as follows:

CASE I.—K. D., a married woman, aged about twenty five or thirty years, first came under the writer's care October 3, 1893. She has been troubled very much for a year or more with vertigo. For this she had been treated for some weeks by her physician, a most intelligent and competent man of large experience. Everything about her general condition had been carefully examined, every disorder which could in any way cause her vertigo had been corrected, but still the annoying symptom persisted. Inasmuch as the patient always referred the vertigo in its beginning to her right ear, she was finally sent to the writer for examination and treatment. She says that the vertigo only comes on when the head is held in a certain position—viz., when it is tipped to the right, as when she

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is lying on her right side at night, or when the head is tipped back and to the right. The vertigo is so severe that she often suffers from nausea, and vomited on one occasion.

She has some tinnitus on the right side. Examination reveals the following: H. D. R., watch, one foot. H. D. L., watch, fifteen feet. Relation of bone and air conduction on both sides was normal. The bone conduction was somewhat greater on the right than on the left.

The lower tone limit on both sides was not changed. A fork of thirty vibrations to the second was heard distinctly. The upper tone limit, as indicated by Galton's whistle, was also normal.

During inflation by Valsalva's method it is impossible to discover any movement of the membrana tympani. The patient does not notice any difference either in the quality or intensity of high musical tones, in changing her head from the vertical position over toward the right side, in which position she always suffers from vertigo.

The right membrana tympani is somewhat retracted and thickened, and in its periphery there are some calcareous deposits. Inflation by Politzer's method influences the hearing very slightly.

The patient was treated by inflations for a few days, but with no relief.

The writer congratulates himself that it was his good fortune during the treatment of the case to have the benefit of numerous useful suggestions from that most skillful aurist, his friend Dr. Edward B. Dench, to whom, moreover, he acknowledges with pleasure his indebtedness for bringing to his notice about this time an article by Dr. Clarence Blake, of Boston.* In this article, entitled *Mechanical Treatment of Tension Anomalies in the Ear*, Blake describes, among others, the following case, which was of such interest that brief allusion will be made to it:

* *Archives of Otolaryngology*, xxi, No. 2, p. 166.

A violinist noticed that when he tilted his head over to the left side, as is the custom in playing this instrument, the tones of the violin sounded dull in the left ear, and at the same time his ability to recognize the differences in quality of notes (timbre perception) was much impaired. The hearing was good, and examination revealed only an intact membrana tympani and a small, round, dry perforation of Shrapnell's membrane. Valsalvian inflation disclosed a considerable movement of the membrana tympani outward, and evidenced a relaxation of the tensor tympani, malleo-incudal capsular ligament, and the corresponding attachments. Blake regarded this ligamentous looseness as the cause of the symptoms, inasmuch as the latter only came on with the head in a certain position. To overcome this excessive ossicular mobility a most ingenious device was employed. He took a small piece of the rubber dam used by dentists (about twelve millimetres long and three millimetres broad); this he inserted in such a way into the auditory canal that the ends lay against the anterior and posterior wall of the meatus, while the central bent portion rested against the short process of the malleus. Thus a pressure from without was exercised (estimated by Blake to be equal to about fifteen milligrammes) which was in a direction favoring the most complete opposition of the malleo-incudal articulating surfaces. This pressure from without counterfeited in a measure the effect of the traction from within. With this rubber in position, the symptoms in Blake's patient (impaired timbre perception) disappeared. It was found necessary to change the shape of the rubber several times before getting the maximum effect. When just the right shape had been secured the patient wore it several weeks with ultimately permanent relief to all his symptoms. Blake's case and that treated by the writer possessed this feature in common, that certain symptoms came on with the head in a certain position. This symptom was, in Blake's case, loss of timbre perception; in the writer's, vertigo. It was determined to make use of this device, and on October 14, 1893, a small piece of rubber was introduced after the manner employed by Blake, as described above.

October 18, 1893.—Rubber still in position. If anything, the

patient is better. She can now sleep on her right side, which she could not do before.

25th.—Says she still has the vertigo, but that it is much less severe. Changed the shape of the rubber slightly. Two weeks later, as a sort of *control* experiment, the rubber was removed. Two days later she returned, saying that the vertigo had been very much worse than it was when the rubber was in place. The day following its removal she had it very bad, with much nausea. She is anxious to have it reintroduced. Used Siegel's otoscope to discover whether there was any twisting movement of the handle of the malleus. When the air in the meatus was rarefied or condensed no such twisting could be detected.

November 16, 1893.—One week later she reports that she has not had a trace of vertigo since the rubber spring was replaced. The hearing distance of the right ear has gone up from one foot to twelve feet, simply as the result of some change produced by the pressure caused by the spring.

21st.—Five days later: No recurrence of the vertigo. H. D. R., fifteen feet.

December 21st.—No return of the vertigo during the past six weeks until the day before yesterday, December 19, 1895, when on rising she found that it had returned, and ever since it has been most distressing. H. D. R. watch has fallen to three feet. Examination revealed that the rubber was no longer in contact with the malleus, and when it was removed it was found to be dry and stiff and possessed no elasticity, having been in position for five or six weeks. A new piece was introduced. A week later it was readjusted, as it was not in good position. Worn for a week. The vertigo was better, but not entirely absent. Can sleep on her right side. The shape of the piece was modified several times, as it was discovered that unless it fitted nicely and pressed exactly on the short process of the malleus the effect was nil. She noticed about January 15th that the motions of the head which produced the vertigo are not so limited in character—*i. e.*, the only motion which does not produce the vertigo is a motion to the left. Her condition during January varied, though she was not entirely free from the vertigo.

March 13th.—Has been much annoyed of late. Can not get up, can not sit down, can not move in any direction without vertigo. Inserted a small paper disc against the membrana tympani in the posterior quadrant. When she returned in a few days the disc had fallen out, and, of course, her condition was unchanged. Put in another disc. A week later she returns much improved. She can move around and turn without vertigo. The disc was pushed tightly in against the membrane.

Ten days subsequently she returned, and reported that since leaving the last time she had not had a trace of vertigo, being absolutely relieved. She could move in any position, could get up suddenly, and her whole head felt better. Two days ago, after coughing rather vigorously in the evening, she seemed to feel the disc move. Since then she has not felt so well. She has had no vertigo, but her head has felt somewhat uncomfortable, and she has had one or two momentary feelings like being seasick. She has not felt badly enough to come to the city for that alone, but as she was in the city she thought best to consult the writer at his office. Examination showed that the disc was not in contact with the membrana tympani except at its periphery. It was therefore pushed back again in good contact with a cotton-tipped applicator. The patient was not seen again for a month, during which she has been entirely free from vertigo until last night, when it returned. She was very much disturbed on reaching my office. Examination again revealed that the disc was not in contact with the membrana. It was again pushed back firmly against the membrana. The patient was seen five hours later the same afternoon, and reported that her vertigo and nausea had entirely disappeared from the time the disc had been replaced. Six weeks later, June 22d, has not had a trace of vertigo or nausea since the last visit.

One month later, July 21st: Went to bed all right last night. On rising, about seven o'clock this morning, she had much vertigo and nausea. Examination revealed the disc dislodged and quite a distance from the membrana. It had not been touched for ten weeks. It was pushed back. Ten days later, July 30th, she reports that the vertigo gradually disap-

peared after her last visit, though not as promptly as it had done before.

November 5th.—Four months later: Has not had any vertigo since the last visit. The ear feels normal in all respects. In December took out the paper disc. Early in February she wrote me that the ear seems to be entirely well. She still has tinnitus, but no vertigo. She trusts the cure will be permanent. (A similar favorable report was received this week, March 20, 1895.)

CASE II.—H. H., aged twenty-four years, Wilmington, Del., seen March 29, 1894. Has noticed for three or four years that his hearing in the right ear was somewhat impaired, and also that when certain musical notes are sounded in his vicinity there is a buzzing or rattling in his ear, lasting while the note continues to sound. This is especially noticeable when his brother, who has a barytone voice, sings in his vicinity. The note E seemed to be the one which produced the symptom to the most marked degree.

H. D. R., watch, eighteen inches; H. D. L., watch, seven feet. Membrana tympani almost normal, but there are some calcareous deposits in its periphery.

The upper and lower tone limits are normal. Inflation produces little change in the hearing. Inserted rubber spring. He said that at a dinner where a gentleman made a speech in a monotonous voice there was a certain note in his voice which, when struck, would almost set him crazy, producing in his ear a sound like the buzzing of a paper over a comb. When he poured water out into a bowl it would sound as though there was water in his ear (as after sea bathing). He could also start it by leaning forward and whistling. Also he seemed able to "tire his ear into it," for in playing accompaniments for a person singing on his right side he would not be annoyed during the first three or four songs. Then it would begin, and any note or song would set his ear buzzing.

April 8, 1894.—Has tried repeatedly, since the rubber was inserted, having his brother sing in order to get the rattling in his ear. Only once, just a little bit, has he succeeded; at all other times it has failed.

Seven months later, November 22, 1894: He has not been annoyed at all of late, except once, at a performance of Rob Roy, two weeks ago. When the cornet in the orchestra struck a loud note it made his ear buzz a moment; but this was only momentary, and no other note or singing produced it. Inserted a paper disc.

CASE III.—Helen G., aged nineteen years, seen April 13, 1894. Complains of exactly the same symptom—of a disagreeable buzzing feeling in her left ear when certain musical notes are struck in her vicinity. Functional examination revealed the ears normal. Inserted rubber spring. Seen one month later. Since the rubber has been in position she has not once perceived the buzzing in her left ear.

In regard to these last two cases their explanation has been given by Helmholtz in *The Mechanism of the Ossicles of the Ear*. This buzzing sound is often produced in the ear as the result of very loud tones. As is well known, the articulation of the malleus and incus is of such a peculiar coglike character that when the malleus is driven inward the incus is pushed along too by the coglike arrangement of the articulation; but when the malleus is driven outward the cogs separate, leaving the incus behind. Helmholtz considers the jarring sound in the ear when loud tones are struck to be caused by the cogs. "When the excursions of the membrana tympani are very great, and during the outward phase of the vibration, the anvil is not driven outward with any considerable force, and can not therefore follow perfectly the excursions of the hammer. The result of this is that the ossicles are separated, and that during the next vibration inward the anvil receives a blow from the returning hammer. This mechanism is also well adapted to the production of combination tones, and the peculiar sensation of buzzing in the ear resulting from the combination tones of two strong soprano voices when thirds are sung can be referred to this jarring which takes place

between the hammer and anvil." When these buzzing sounds are present to an abnormal degree one could well imagine an undue looseness of the ossicular ligaments. If the cogs are widely separated, as by increasing the air pressure in the middle ear, the buzzing ceases. Also in case the ligaments are too loose the introduction of the little spring in the manner described would tighten up the articulating surfaces and put them in such close contact that the buzzing would cease, as was true in the last two cases.

Now let us consider briefly some features of the first case. Let us look at all the conditions without prejudice for or against, and see whether we are really justified in holding that the mechanical devices used had anything to do with the disappearance of the vertigo.

That the latter was of aural origin was always suspected by the patient herself, who referred its inception invariably to the right ear. Always during the persistence of the vertigo her right ear felt "stuffy," and the tinnitus was worse. Again, the hearing in that ear for the watch was at first only one foot, while in the left it was fifteen feet. Inflation did not improve the hearing in her right ear. But after the rubber spring had been introduced so as to fit, examination showed that the hearing distance for the watch had increased on that side to twelve feet.

That the symptom was some tension anomaly, probably due to some ligamentous laxness, was suggested by the fact that the vertigo was always brought on by tipping the head to the right side, or back and to the right. In the commencement of the treatment the writer was extremely skeptical as to the influence of the devices used in relieving the symptom. There had previously been times during which she had been free from her trouble, so that one naturally would at first consider that the disappearance of the vertigo after employing the device was simply a coin-

cidence—merely a case of “post” but not of “propter.” Yet this “coincidence” became such a very frequent occurrence that one was no longer justified in regarding it as merely a “coincidence.” Let us recall a few only of these. The patient comes in; the rubber has been in position about three weeks, and her vertigo has been much less. As a “control” experiment rubber was removed. Two days later she returned, saying that the vertigo had been very much worse the past two days. She has had nausea, and is anxious to have the rubber reintroduced, which was done, and at her next visit, a week later, she reported that she had not had a trace of vertigo since the prop was replaced.

Again, after the use of the paper disc was begun she had gone for two weeks with perfect comfort; could put the head in any position without bringing on her old trouble. After coughing violently she felt the paper disc in her ear move, and at once her vertigo returned, and with this there was an uncomfortable, stuffy feeling in the ear. On examination, the disc was found tilted away from the drum membrane, having been dislodged very probably at the time she coughed. With a cotton-tipped applicator the disc was pressed firmly back in position. She was requested to return the same afternoon, which she did. Her vertigo had entirely disappeared, and she was not seen again for a month.

Such experiences as these became so frequent that the writer's skepticism vanished, and he was convinced that the pressure exerted by the rubber, and eventually by the paper disc, was the ætiological factor at work in relieving his patient.

As to *how* it did this one can only speculate, in the absence of more exact knowledge in regard to the phenomena of vertigo. Dizziness as the result of rotation has been stud-

ied by several observers in normal men and in deaf-mutes, but a comparison of symptoms, with pathological changes in the internal ear, has been made in extremely few cases. Dr. Frederick S. Lee, of this city, who has himself made elaborate investigation as to the function of the semicircular canals in fishes, kindly gave the writer the benefit of his experience. It was his opinion that, reasoning from his observations in fishes, one could locate with probability the lesion, if it was in the semicircular canals, by the direction in which the patient seemed to be falling during the attack of vertigo. The fact that in the writer's case "the motion was circular, everything seemed to go around," would seem to indicate that no one semicircular canal alone was disturbed, but all, or possibly, as Dr. Lee suggests, "the otolithic parts." Also, this disturbance in the labyrinthine pressure might be produced by a minute movement of the ossicular chain attending a tilting of the head if the articular ligaments were loose. In considering certain aural conditions, one is oftentimes impressed by the conspicuous character of the symptoms which are produced by exceedingly minute changes in the parts. For example, Helmholtz has shown that the excursions of the *stapes* in the fainter (though yet clearly to be distinguished) tones must be so small as to escape detection even with the highest powers of our modern microscopes. A similarly minute movement could well be sufficient to bring about pressure changes in the labyrinth capable of causing the vertigo.

In conclusion, there are one or two points in regard to the technique to which it may not be amiss to allude. The little piece of rubber is seized by its two ends with the angular ear forceps; the convex-bent middle is smeared with a little vaseline; it is then inserted through the speculum until it is in contact with the short process of the malleus. The rubber is then released, one end falling against

the anterior, the other end against the posterior, wall of the meatus. It is now carefully examined to see whether it is in accurate contact with the short process. To be sure of this, it is well to push it back lightly with a cotton-tipped applicator. The soft rubber produces no irritation, and the patient is not conscious of the presence of anything unusual in the ear. It is sometimes extremely difficult to remove the rubber, as it clings either to the membrana tympani or to the wall of the meatus. To facilitate the removal, the writer passed a fine silk thread through the layers of the rubber about its middle, but tied no knot in the silk. The end of the silk thread was cut long enough, so that when the rubber was in position the thread lay in the meatus, and could easily be seized with the forceps and thus the rubber pulled out. Once only was any irritation produced, and that was when he tied a knot in the silk, and this knot, when the rubber was in position, pressed upon the membrana tympani, producing pain and redness, so that the device had to be removed. He then passed the silk through the layers of the rubber and tied no knot in it, and no further irritation was produced.

The paper disc can be inserted by smearing the end of a cotton-tipped applicator with a little vaseline, pressing it on the disc, which thus adheres to the applicator and can be pushed into position. When it is in contact with the membrana tympani it remains adherent there on withdrawing the applicator. When it is desired to remove the disc it can be syringed out with warm water, or a short piece of fine silk thread can be attached to the middle of the disc by a bit of wax. This thread can then be seized by the forceps when the disc is in position, and thus the latter can be readily removed.

As Blake says: "The treatment must be long continued to get any permanent result in a condition which has be-

come essentially chronic by the time it is brought to the attention of the surgeon.

“Still further, it should be said that the adjustment of such mechanical appliances must always be a matter of more or less experiment, since the questions of the weight and position of, and the degree of pressure exercised by, the dressing are variable factors, which must be apportioned to the individual needs of the case under consideration.

“The fact, therefore, that the application does not give immediate relief by no means justifies the conclusion that it can not be of service, since the effect may follow later, or may be more immediately brought about by slight change in adjustment.”

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